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(54) Abstract Title
Compensating thermal expansion in carding machines

(57) To maintain a constant gap thickness between the clothing 4a of a carding cylinder and clothed or non-clothed elements 14 supported by side screens 17 when the machine heats up during operation, the thermal expansion characteristics of the cylinder and side screens are matched to each other. This may be attained by thermal barriers 30 to prevent loss of heat from the side screens to the exterior. The coefficients of expansion of the materials of the cylinder and side screen may be the same or different, e.g. the side screens having a higher coefficient.

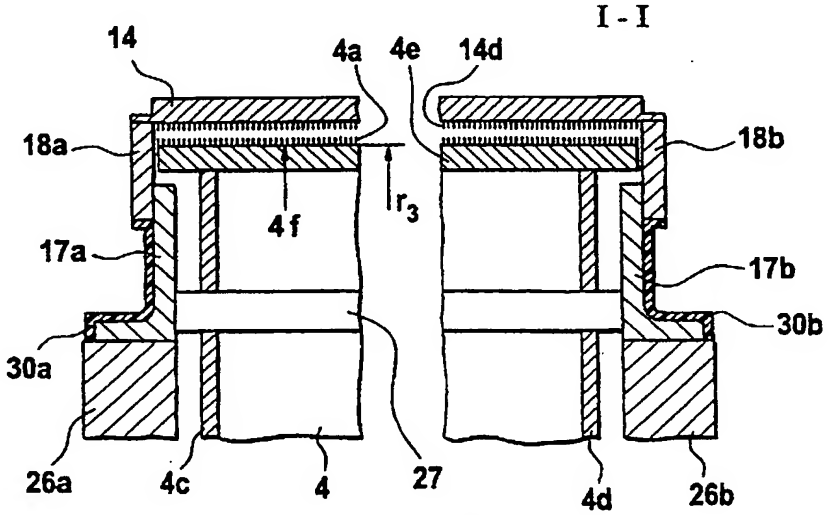

Fig. 2b

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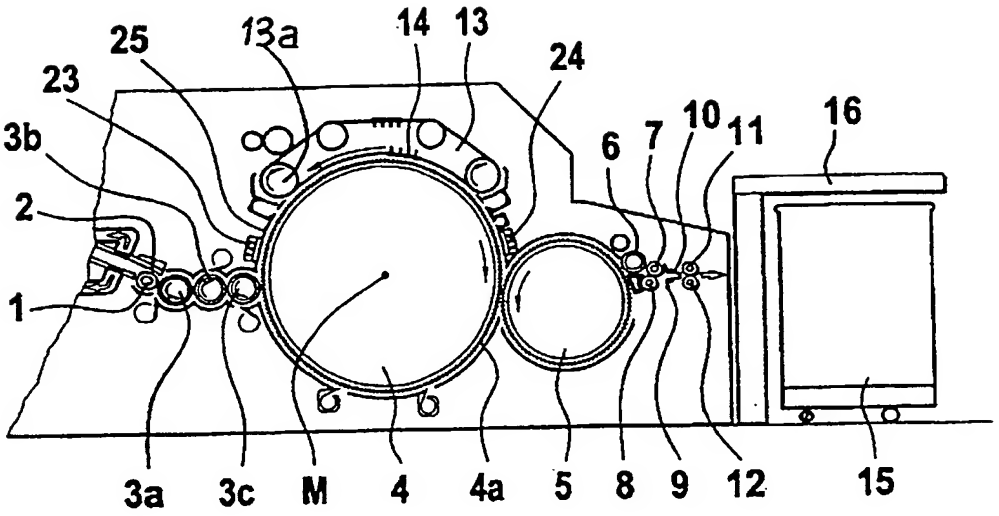
25
13a
14
13
24
23
3b
2
1
6
7
10
11
16
3a
3c
M
4
4a
5
8
9
12
15

Fig. 1

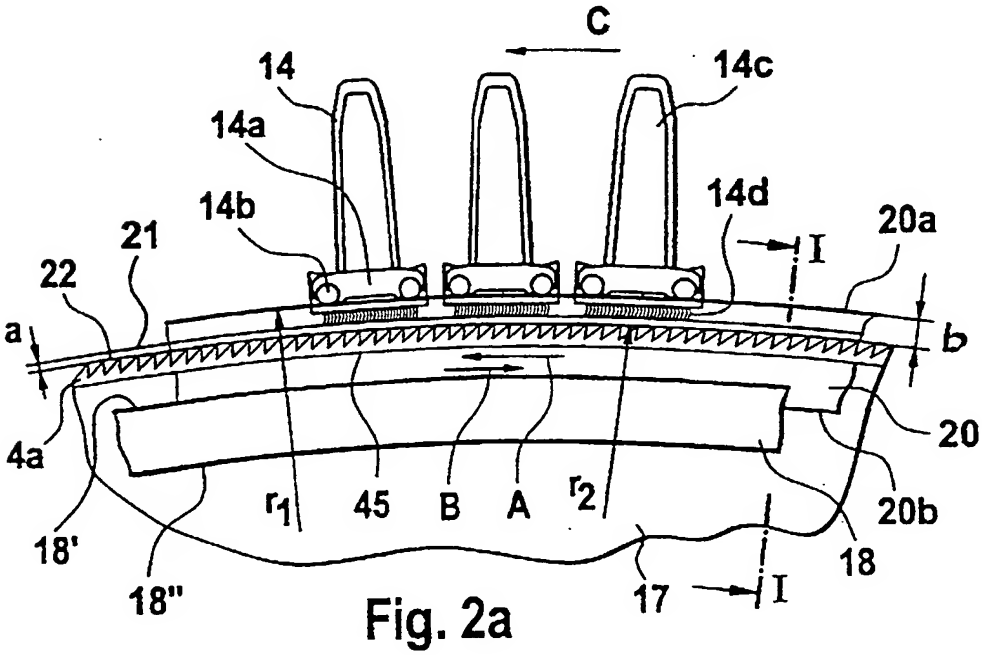
C
14
14c
14a
14b
14d
20a
21
22
I
a
b
4a
20
20b
18'
18"
r_1
45
B
A
r_2
18
17
I

Fig. 2a

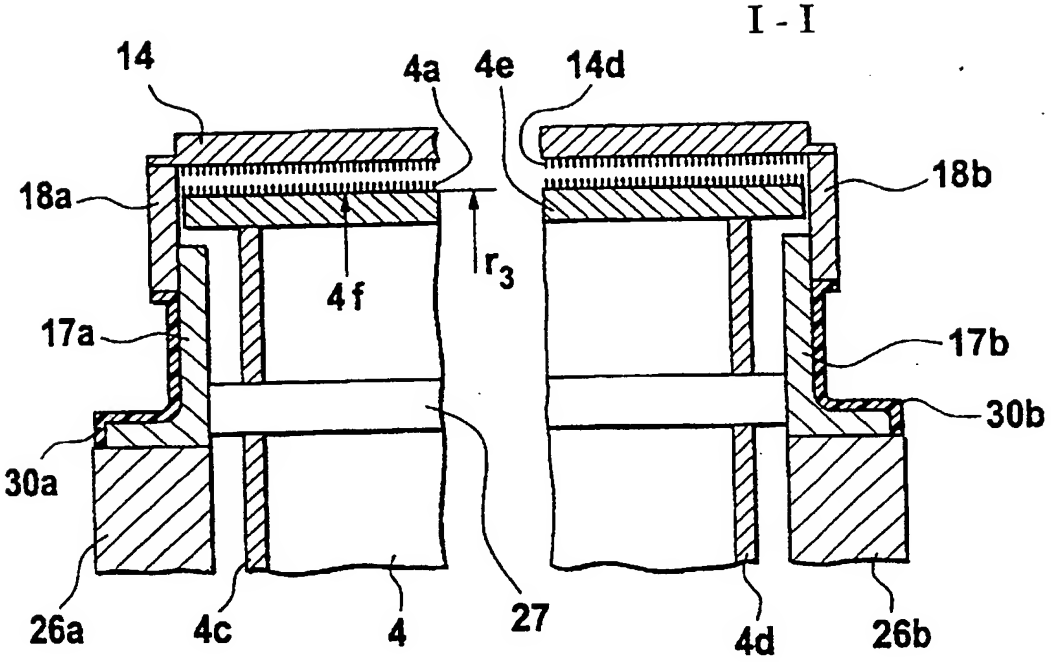

Fig. 2b

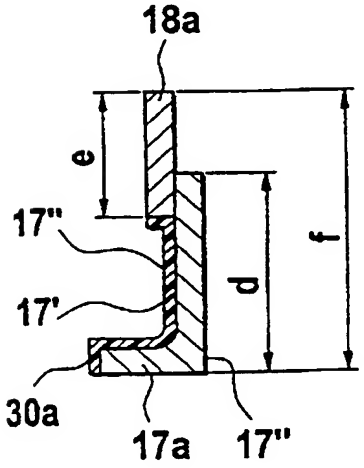

Fig. 2c

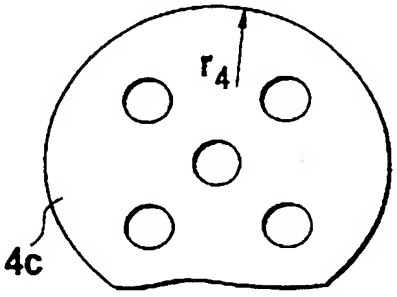

Fig. 2d

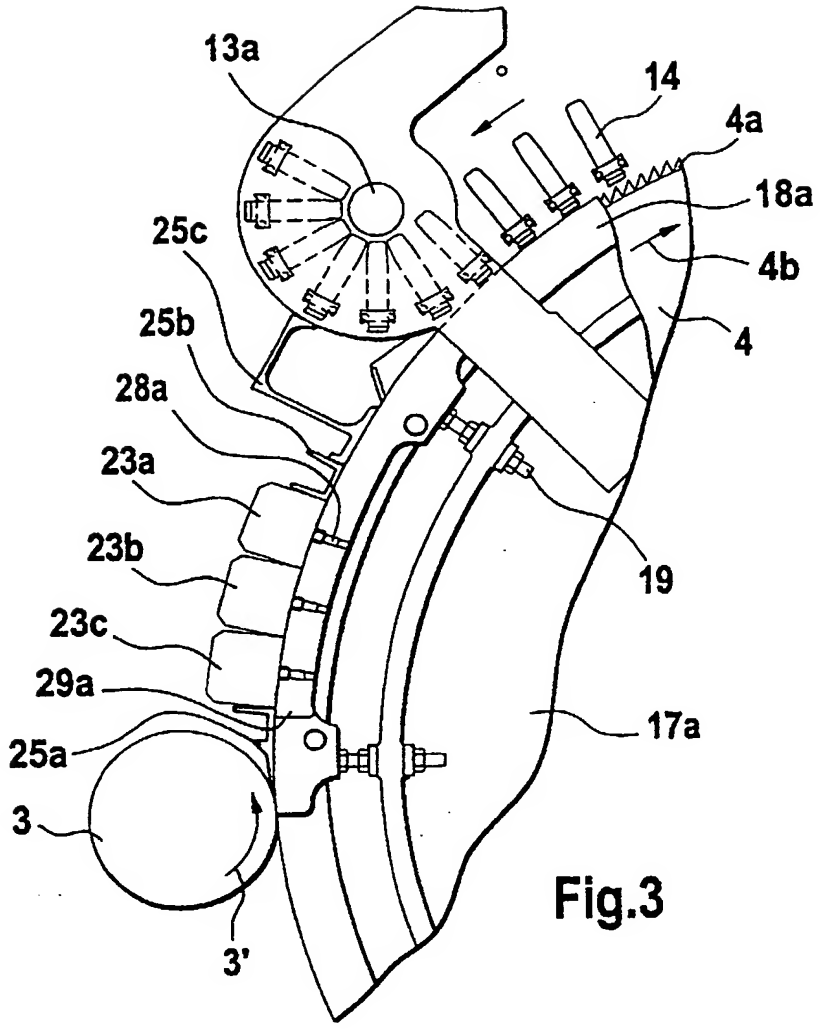
13a
14
4a
18a
4b
4
25c
25b
28a
23a
23b
23c
29a
25a
3
3'
19
17a

Fig.3

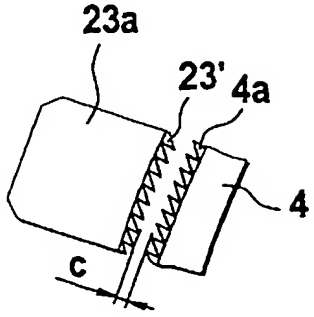
23a
23'
4a
4
c

Fig.3a

Improvements in or relating to carding machines

The invention relates to a carding machine and to a method of operating a carding machine.

A known carding machine has a cylinder provided with a cylindrical, clothed wall and at least two radial support elements. The machine has at least one clothed, and/or not clothed, machine element located opposite the cylinder clothing at a spacing therefrom and two stationary side screens, to which there are attached mounting devices (for example flexible bends or other sliding bends) for work elements such as carding elements of a revolving card top or stationary carding elements. The work elements, with or without other parts, cover over the cylinder so that the cylinder is enclosed.

The effective spacing of the tips of a clothing on a carding cylinder from a machine element located opposite the clothing is called a carding nip. The machine element often also has a clothing but could, instead, be formed by an encasing segment having a guide surface. The carding nip is decisive for determining the carding quality. The size (width) of the carding nip is a fundamental machine parameter, which influences both the technology (the fibre processing) and also the running characteristics of the machine. The carding nip is set as narrow as is possible (it is measured in tenths of a millimetre) without running

the risk of a "collision" between the work elements. In order to ensure that the fibres are processed evenly, the nip must be as uniform as possible over the entire working width of the machine.

The carding nip is especially influenced by, on the one hand, the machine settings and, on the other hand, the condition of the clothing. The most important carding nip in a carding machine having a revolving card top is located in the main carding zone, that is to say between the cylinder and the revolving card top. At least one of the clothings bounding the carding nip is in motion, usually both. In order to increase the production of the carding machine, the speed of rotation or velocity of the moving elements, in use, is made as high as fibre processing technology will allow. The width of the carding nip changes as a function of the operational conditions, the change occurring in the radial direction (starting from the axis of rotation) of the cylinder.

In carding, larger amounts of fibre material are increasingly being processed per unit time, which results in higher speeds for the work elements and higher installed capacities. Increasing fibre material throughflow (production) leads to increased generation of heat as a result of the mechanical work, even when the conditions at the carding nip remain constant. At the same time, however, the technological result of carding (web uniformity, degree

of cleaning, reduction of neps etc.) is being continually improved, leading to more work surfaces in carding engagement and to closer settings of those work surfaces with respect to the cylinder (drum). The proportion of synthetic fibres being processed is continually increasing, with more heat, compared with cotton, being produced as a result of friction from contact of the fibres with the work surfaces of the machine. The work elements of high-performance carding machines today are fully enclosed on all sides in order to meet the high safety standards, to prevent emission of particles into the spinning room environment and to minimise the maintenance requirement of the machines. Gratings or even open material-guiding surfaces, which allow an exchange of air, belong to the past. As a result of the circumstances mentioned, there is a marked increase in the input of heat into the machine whereas there is a marked decrease in the heat removed by means of convection. The resulting increase in the heating of high-performance carding machines results in greater thermoelastic deformations, which, because of the unequal temperature field distribution, influence the set spacings of the work surfaces: the spacings between the cylinder and the card top, doffer, fixed card tops and separating-off locations decrease. In extreme cases, the nip set between the work surfaces can be completely used up as a result of thermal expansion so that components in relative motion

collide, causing major damage to the high-performance carding machine concerned. Accordingly, it is especially possible for the generation of heat in the work region of the carding machine to result in different thermal expansions of different components when the temperature differences between the components are too large.

In a known apparatus (EP 0 431 485), a channel is provided, through which a medium flows in order to remove heat from a clothed, or not clothed, cylinder casing or from the bars of the card top. As a result, when thermal expansion of the cylinder occurs, the carding nip is, undesirably, reduced even further. A fluid transport system inside the cylinder has already been proposed for compensation of the temperature conditions at the external periphery of the cylinder. Access to a fluid transport system of that kind can, in use, be gained only by way of the cylinder shaft, which greatly restricts the possibilities for influencing the conditions in the said system so that the objective (uniform temperature conditions) cannot be met. It is disadvantageous that the system is, in terms of its configuration, extraordinarily complicated. Furthermore, the energy consumption for the cooling system is too high.

The object of the invention is therefore to provide a carding machine and a method of operating a carding machine that avoids or mitigates the mentioned disadvantages. More

particularly it is an object of the invention to provide a carding machine that makes possible, by simple means, the provision of a carding nip, between the cylinder clothing and the clothed, and/or not clothed, counterpart element, that remains constant, or more constant than would otherwise be the case, when there is thermal expansion during operation.

According to the invention there is provided a carding machine including a cylinder provided with a cylindrical clothed wall, at least two radially extending support elements for supporting the wall, at least one machine element including a working surface confronting the clothed wall of the cylinder and spaced therefrom, and a pair of side screens at opposite sides of the machine, the side screens serving to mount said at least one machine element, wherein the machine further includes thermal barrier means for reducing the transfer of heat outwardly from the side screens, whereby the change in spacing between the working surface of said at least one machine element and the clothed wall of the cylinder as a result of thermal expansion is substantially reduced from that which would apply if the thermal barrier means were not present.

Also according to the invention there is provided an apparatus at a carding machine having a cylinder provided with a cylindrical, clothed wall and at least two radial support elements, and having at least one clothed, and/or

not clothed, machine element located opposite the cylinder clothing at a spacing therefrom and two stationary side screens, to which there are attached holding devices for work elements, for example sliding bends, stationary carding elements, cylinder coverings, wherein the cylinder is enclosed, characterised in that the removal of heat from the side screens to the outside is reduced, the expansion behaviour of the side screens being matched to the expansion behaviour of the cylinder when there are changes in temperature.

As a result of the fact that the removal of heat from the side screens to the outside is reduced, it is possible, by especially simple means, to achieve a work spacing that remains substantially constant or more nearly constant when there is thermal expansion. In spite of the different possibility for the removal of heat from the cylinder and from the side screens, the work spacing between the cylinder clothing and the clothed, or not clothed, surface located opposite nevertheless can remain substantially constant. It is especially advantageous that the work elements located opposite the cylinder can remain structurally unchanged because they are carried by the side screens. Accordingly, the difference in the expansion behaviour of the side screens and of the cylinder is especially compensated by the difference in the removal of heat from the cylinder, which is enclosed, and the side

screens, which are in communication with the external air. As a result of the measures according to the invention, the thermal expansion of the side screens is enhanced.

Advantageously, the temperature difference between structural elements is compensated by less removal of heat from the side screens. Preferably, the temperature difference between structural elements is compensated by a lower coefficient of thermal expansion of the cylinder. Advantageously, the side screens are thermally insulated on their sides facing away from the cylinder. Preferably, a thermally insulating finish or the like is provided. Advantageously, a thermally insulating coating, insulating panel or the like, for example Styropor (R.T.M.), is provided. Preferably, the expansion behaviour of the radial support elements is matched to the expansion behaviour of the side screens. Advantageously, the expansion behaviour of the wall is matched to the expansion behaviour of the side screens. Preferably, the expansion behaviour of the radial support elements is matched to the expansion behaviour of the wall. Advantageously, the radial support element consists of a disc having holes. Preferably, the radial support element consists of spokes, a rim and a hub. Advantageously, a casing is associated with the outside of the side screens.

The material of the side screens on the one hand and the material of the radially extending support elements and/or

the cylindrical clothed wall on the other hand preferably have substantially the same coefficients of thermal expansion; in an embodiment of the invention described below there is a difference of about ten per cent in the coefficients of thermal expansion. The variation can, however, be greater or less in which case the amount of thermal insulation adopted for the side screens should be adjusted appropriately. For example, if the side screens are made of aluminium or an aluminium alloy, which has a relatively high coefficient of thermal expansion, less thermal insulation may be employed.

In another aspect of the invention, it encompasses a further advantageous apparatus at a carding machine having a cylinder provided with a cylindrical, clothed wall and at least two radial support elements, and having at least one clothed, and/or not clothed, machine element located opposite the cylinder clothing at a spacing therefrom and two stationary side screens, to which there are attached holding devices for work elements, for example sliding bends, stationary carding elements, cylinder coverings, wherein the cylinder is enclosed, in which apparatus heat is supplied to the side screens, the expansion behaviour of the side screens being matched to the expansion behaviour of the cylinder when there are changes in temperature. Also according to said another aspect of the invention, there is provided a carding machine including a cylinder

provided with a cylindrical clothed wall, at least two radially extending support elements for supporting the wall, at least one machine element including a working surface confronting the clothed wall of the cylinder and spaced therefrom, and a pair of side screens at opposite sides of the machine, the side screens serving to mount said at least one machine element, wherein the side screens are arranged to undergo thermal expansion as the machine warms up during use, the cylinder is arranged to undergo thermal expansion as the machine warms up during use and said thermal expansions are matched such that there is no significant change in spacing between the working surface of said at least one machine element and the clothed wall of the cylinder as a result of said thermal expansions.

As will be understood, in the invention according to said another aspect, the expansion behaviour may be matched by providing a thermal barrier means and/or by selection of materials chosen according to their coefficients of thermal expansion, and/or by any other suitable means. The invention according to said another aspect may include any of the features referred to above when describing the invention according to the first-mentioned aspect.

An embodiment of the invention will be described hereinafter by way of example with reference to the drawings, in which:

Fig. 1 shows, in a diagrammatic side view, a carding machine including a revolving card top;

Fig. 2a shows, in a diagrammatic side view, card top bars of the revolving card top and a portion of a slideway together with a side screen;

Fig. 2b shows, in a diagrammatic representation, a section I - I through the slideway and side screen of Fig. 2a;

Fig. 2c is a sectional view corresponding to Fig. 2b of a part of the arrangement shown in Fig. 2b;

Fig. 2d is a side view of an end wall of the carding cylinder;

Fig. 3 shows, in a diagrammatic side view, part of a side screen together with flexible bend, carding cylinder, stationary carding elements, cylinder covering elements and card top bars; and

Fig. 3a shows the spacing between the clothing of one of the stationary carding elements and the cylinder clothing.

Fig. 1 shows a carding machine, for example of the kind manufactured and sold by Trützschler GmbH & Co KG as a Trützschler EXACTACARD (A.T.M.) DK 803, having a feed roller 1, feed table 2, lickers-in 3a, 3b, 3c, cylinder 4, doffer 5, stripper roller 6, nip rollers 7, 8, web-guiding element 9,

sliver funnel 10, delivery rollers 11, 12, revolving card top 13 with card top bars 14, can 15 and can coiler 16. The directions of rotation of the rollers are denoted by curved arrows. Reference letter M denotes the centre point (axis or shaft) of the cylinder 4. Stationary carding elements 23 are provided between the licker-in 3 and the card top guide roller 13a and stationary carding elements 24 are provided between the doffer 5 and the card top guide roller 13b. Reference numeral 25 denotes the cylinder casing (cylinder covering elements).

Referring now also to Figs. 2a and 2b, an approximately semi-circular, rigid side screen 17a, 17b on each side of the carding machine is fastened laterally to the machine frame 26a, 26b respectively. On the outer side of the side screen 17, in the region of its outer periphery, concentrically, there is fixed an arcuate mounting element (flexible bend) 18a, 18b respectively. Each mounting element has, as a support surface, a convex outer surface 18' and an underside 18''. On top of the mounting element 18 there is a slideway 20, for example made of low-friction plastics material.

As will be understood, the arrangements of the two sides of the carding machine are substantially the same. In Fig. 2b parts on one side are denoted by adding the letter 'a' after the reference numeral whilst parts on the other side are denoted by adding the letter 'b' after the reference

numeral. On the other hand in Fig. 2a, which shows only one side, no suffix letter is added for the purpose of denoting any particular side of the machine.

Each of the card top bars 14 has, at its end, a card top head 14a, to which there are affixed in the axial direction two steel pins 14b, which slide on the convex outer surface 20a of the slideway 20 in the direction of arrow C. Mounted on the base surface of the carrier 14c is the card top clothing 14d. Reference numeral 21 denotes the circle of the tips of the card top clothings 14d. The cylinder 4 has on its circumference a cylinder clothing 4a, for example saw tooth clothing. Reference numeral 22 denotes the circle of the tips of the cylinder clothing 4a. The spacing between the circle of tips 21 and the circle of tips 22 is denoted by reference letter a and is, for example, 0.20 mm. The spacing between the convex outer surface 20a and the circle of tips 22 is denoted by reference letter b. The radius of the convex outer surface 20a is denoted by reference letter r_1 and the radius of the circle of tips 22 is denoted by reference letter r_2. The radii r_1 and r_2 intersect at the centre point M (see Fig. 1) of the cylinder 4. On each side, the stationary carding elements 23a, 23b, 23c and 24 are mounted, by means of screws 28 in each case, on an extension bend 29 (see Fig. 3 where screw 28a for element 23a is referenced), which is in turn attached (on each side

of the carding machine) to the side screen 17a and 17b (only 17a is shown in Fig. 3).

Fig. 2b shows a portion of the cylinder 4 together with the cylindrical surface 4f of its cylindrical wall 4e and cylinder bases (end walls) 4c, 4d (radial support elements). The surface 4f is provided with a clothing 4a, which in this example is provided in the form of wire having sawteeth. The sawtooth wire is drawn onto the cylinder 4, that is to say is wound on in closely adjacent windings between side flanges (not illustrated) to form a cylindrical work surface provided with tips. The fibres should be processed on the work surface as uniformly as possible. The carding work is performed between the clothings located opposite one another and is substantially influenced by the position of one clothing with respect to the other and by the clothing spacing a between the tips of the teeth of the two clothings. The working width of the cylinder 4 is decisive for all the other work elements of the carding machine, especially for the revolving card top 14 or stationary carding elements 23, 24, which together with the cylinder 4 card the fibres uniformly over the entire working width. In order to be able to perform uniform carding work over the entire working width, the settings of the work elements (including additional elements) must be maintained over that working width. However, the cylinder 4 itself can become deformed as a

result of the drawing on of the clothing wire, centrifugal force or heating caused by the carding process. The shaft 27 of the cylinder 4 is mounted in bearings (not illustrated), which are attached to the stationary machine frame 26a and 26b, respectively. The diameter, for example 1250 mm, of the cylindrical wall 4f, that is to say twice the radius r_3, is an important dimension of the machine and, in use, it becomes larger as a result of heat produced by work. The side screens 17a, 17b are fastened to the two machine frames 26a and 26b, respectively. The two flexible bends 18a and 18b are fastened to the side screens 17a and 17b, respectively. As shown in Fig. 2c, the side screen 17a (and also 17b) has a radial dimension d and the flexible bend 18a (and also 18b) has a dimension e.

As shown in Fig. 3, between the licker-in 3 and the card top guide roller 13a there are provided, in fixed locations, three stationary carding elements 23a, 23b, 23c and cylinder encasing elements 25a, 25b, 25c. As shown in Fig. 3a, the stationary carding elements 23 have a clothing 23' located opposite the cylinder clothing 4a. Reference letter c denotes the carding nip between the clothing 23' and the cylinder clothing 4a. The stationary carding elements 23 (by means of screws 28a) and the covering elements 25 (by means of screws that are not illustrated) are attached to an extension bend 29a. Fig. 3 shows only the extension bend 29a on one side of the

carding machine. The extension bend 29a is in turn fastened on each side of the carding machine to the carding machine screen 17a and 17b (Fig. 3 shows only 17a).

The flexible bends 18a, 18b are fastened to the side screens 17a and 17b, respectively, by means of screws 19.

When, in use, as a result of carding work, heat is produced in the carding nip a between the clothings 14d and the cylinder clothing 4a (or in the carding nip c shown in Fig. 3a between the clothings 23' and the cylinder clothing 4a), especially when production is high and/or synthetic fibres or cotton/synthetic fibre mixtures are being processed, the cylinder wall 4e expands, that is to say the radius r_3 increases and the carding nips a and c decrease. The heat is directed, by way of the cylinder wall 4e, into the radial support elements, the cylinder end walls 4c and 4d. As a result, the cylinder end walls 4c, 4d likewise expand, that is to say the radius r_4 (Fig. 2d) increases. The cylinder 4 is almost completely encased (enclosed) on all sides - in a radial direction by the elements 14, 23, 24, 25 (see Fig. 1) and to the two sides of the carding machine by the elements 17a, 17b, 18a, 18b, 26a, 26b. As a result, hardly any heat is radiated from the cylinder 4 to the outside (to the atmosphere). However, a considerable amount of the heat of the large-area cylinder end walls 4c, 4d is especially transferred by radiation to the large-area side screens 17a, 17b, from which the heat

is radiated out to the relatively cool atmosphere. As a result of the amount of that radiation, the expansion of the side screens 17a, 17b is liable to be less than that of the cylinder end walls 4c, 4d, which would lead to an undesirable carding result or a hazardous reduction in the carding nip a (Fig. 2a) and the carding nip c (Fig. 3a). The carding elements (card top bars 14) are mounted on the flexible bends 18a, 18b and the stationary carding elements 23, 24 are mounted on extension bends 29a, which are in turn fastened to the side screens 17a, 17b (Fig. 3). As seen in Fig. 2c, on heating, the increase of the spacing d and with it of the spacing e leads to an increase in the overall dimension f that is relatively less, for the same thermal expansion coefficient, than the radius r_4 of the cylinder end walls 4c, 4d and the radius r_3 of the cylinder wall 4e. The cylinder wall 4e and the cylinder end walls 4c, 4d are made of steel, for example St 37, having a longitudinal thermal expansion coefficient of 11.5×10^{-6} /°K. In order, therefore, to balance out the relatively different potential for expansion of the cylinder end walls 4c, 4d and the cylinder wall 4e, on the one hand, and the side screens 17a, 17b (caused by impeded net radiation into the atmosphere from the cylinder resulting from its enclosure and free radiation into the atmosphere from the side screens, respectively), the side screens 17a, 17b (which are made from a material having a similar

longitudinal thermal expansion coefficient to steel, for example from grey cast iron having a longitudinal thermal expansion coefficient of 10.5 X 10^{-6} /°K) are at least in part provided, on their outer faces 17' - that is to say on the side exposed to the outside atmosphere - with a thermally insulating layer 30a and 30b, respectively, for example Styropor (R.T.M.) or the like, which reduces the radiation of heat to the outside. By that means, even though the cylinder 4 expands because of the lack of heat removal due to enclosure, expansion of the side screens (spacing d, Fig. 2c) is retained because of the thermal insulation. The heat radiated from the cylinder end walls 4c, 4d remain in the side screens 17a and 17b, respectively. As a result, the undesirable reduction in the carding nip a and/or c caused by thermal factors is avoided.

Claims

1. A carding machine including a cylinder provided with a cylindrical clothed wall, at least two radially extending support elements for supporting the wall, at least one machine element including a working surface confronting the clothed wall of the cylinder and spaced therefrom, and a pair of side screens at opposite sides of the machine, the side screens serving to mount said at least one machine element, wherein the side screens are arranged to undergo thermal expansion as the machine warms up during use, the cylinder is arranged to undergo thermal expansion as the machine warms up during use and said thermal expansions are matched such that there is no significant change in spacing between the working surface of said at least one machine element and the clothed wall of the cylinder as a result of said thermal expansions.

2. Apparatus at a carding machine having a cylinder provided with a cylindrical, clothed wall and at least two radial support elements, and having at least one clothed, and/or not clothed, machine element located opposite the cylinder clothing at a spacing therefrom and two stationary side screens, to which there are attached holding devices for work elements, for example sliding bends, stationary carding elements, cylinder coverings, wherein the cylinder is enclosed, characterised in that heat is supplied to the

side screens, the expansion behaviour of the side screens being matched to the expansion behaviour of the cylinder when there are changes in temperature.

3. A carding machine including a cylinder provided with a cylindrical clothed wall, at least two radially extending support elements for supporting the wall, at least one machine element including a working surface confronting the clothed wall of the cylinder and spaced therefrom, and a pair of side screens at opposite sides of the machine, the side screens serving to mount said at least one machine element, wherein the machine further includes thermal barrier means for reducing the transfer of heat outwardly from the side screens, whereby the change in spacing between the working surface of said at least one machine element and the clothed wall of the cylinder as a result of thermal expansion is substantially reduced from that which would apply if the thermal barrier means were not present.

4. A carding machine according to claim 3, in which the thermal barrier means comprises thermal insulation on the outwardly directed sides of the side screens.

5. A carding machine according to claim 3 or 4, in which the thermal barrier means comprises a respective thermally insulating panel secured to each of the side screens.

6. A carding machine according to claim 3 or 4, in which the thermal barrier means comprises a respective thermally insulating coating applied to each of the side screens.

7. A carding machine according to any preceding claim, in which the material of the side screens on the one hand and the material of the radially extending support elements and/or the cylindrical clothed wall on the other hand have substantially the same coefficients of thermal expansion.

8. A carding machine according to any of claims 3 to 6, in which the material of the side screens on the one hand and the material of the radially extending support elements and/or the cylindrical clothed wall on the other hand have different coefficients of thermal expansion.

9. A carding machine according to claim 8, in which the coefficient of thermal expansion of the material of the side screens is higher than the coefficient of thermal expansion of the material of the radially extending support elements.

10. A carding machine according to claim 8 or 9, in which the coefficient of thermal expansion of the material of the side screens is greater than that of steel.

11. A carding machine according to any preceding claim, in which the side screens are made of aluminium or an aluminium alloy.

12. A carding machine according to any preceding claim, in which the side screens are made from a cast material.

13. A carding machine according to claim 12, in which the side screens are made from cast iron.

14. A carding machine according to any preceding claim, in which each radial support element comprises a disc having a plurality of holes therethrough.

15. A carding machine according to any one of claims 1 to 13, in which each radial support element comprises a plurality of spokes, the spokes extending outwardly from a hub.

16. A carding machine according to any preceding claim, in which the material forming the cylindrical clothed wall of the cylinder and the material forming the radial support elements is of substantially the same coefficient of thermal expansion.

17. A carding machine according to any preceding claim, in which the material forming the carding cylinder is of substantially the same coefficient of thermal expansion throughout.

18. A carding machine according to any preceding claim, in which the cylinder is formed of the same material throughout.

19. A carding machine according to claim 18, in which the cylinder is made of Invar (R.T.M.) steel.

20. A carding machine according to any preceding claim, in which the arrangement is such that there is no substantial change in spacing between the working surface of said at least one machine element and the clothed wall of the

cylinder as a result of thermal expansion as the machine warms up during use.

21. A carding machine according to any preceding claim, in which said at least one machine element comprises a carding element of a revolving card top.

22. A carding machine according to any preceding claim, in which said at least one carding element comprises a fixed carding element.

23. A carding machine according to any preceding claim, further including a pair of side frame members on which the cylinder is mounted, the side screens being mounted upon and extending upwardly from the side frame members.

24. A carding machine according to claim 23, in which slide elements for card top bars of a revolving card top are mounted on the tops of the side screens.

25. A carding machine according to claim 24, in which mounting elements for fixed carding elements are mounted on the tops of the side screens.

26. Apparatus at a carding machine having a cylinder provided with a cylindrical, clothed wall and at least two radial support elements, and having at least one clothed, and/or not clothed, machine element located opposite the cylinder clothing at a spacing therefrom and two stationary side screens, to which there are attached holding devices for work elements, for example sliding bends, stationary carding elements, cylinder coverings, wherein the cylinder

is enclosed, characterised in that the removal of heat from the side screens to the outside is reduced, the expansion behaviour of the side screens being matched to the expansion behaviour of the cylinder when there are changes in temperature.

27. Apparatus according to claim 26, characterised in that the temperature difference between structural elements of the carding machine is compensated by less removal of heat from the side screens.

28. Apparatus according to claim 26 or claim 27, characterised in that the temperature difference between structural elements of the carding machine is compensated by a lower thermal expansion of the cylinder.

29. Apparatus according to any one of claims 26 to 28, characterised in that the side screens are thermally insulated on their sides facing away from the cylinder.

30. Apparatus according to any one of claims 26 to 29, characterised in that a thermally insulating finish or the like is provided.

31. Apparatus according to any one of claims 26 to 30, characterised in that a thermally insulating coating, insulating panel or the like, e.g. Styropor (R.T.M.), is provided.

32. Apparatus according to any one of claims 26 to 31, characterised in that the expansion behaviour of the radial support elements is matched to the expansion behaviour of the side screens.

33. Apparatus according to any one of claims 26 to 32, characterised in that the expansion behaviour of the wall is matched to the expansion behaviour of the side screens.

34. Apparatus according to any one of claims 26 to 33, characterised in that the expansion behaviour of the radial support elements is matched to the expansion behaviour of the wall.

35. Apparatus according to any one of claims 26 to 34, characterised in that the radial support element consists of a disc having holes.

36. Apparatus according to any one of claims 26 to 35, characterised in that the radial support element consists of spokes, a rim and a hub.

37. Apparatus according to any one of claims 26 to 35, characterised in that a casing is associated with the outside of the side screens.

38. A method of operating a carding machine according to any preceding claim, in which the carding cylinder expands radially as it warms up during use.

Application No:	GB 0314319.5	**Examiner:**	Alex Littlejohn
Claims searched:	1,2; 7,11-25 when appendant to claims 1,2; 26-38	**Date of search:**	7 July 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X,E	1,2,26 at least	EP 1031650 A	(Rieter) see whole document
X	1,2,26 at least	US 4499632	(Varga) see whole document

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO, & US patent documents classified in the following areas of the UKC[V]:

D1N

Worldwide search of patent documents classified in the following areas of the IPC[7] :

D01G

The following online and other databases have been used in the preparation of this search report :

EPODOC, JAPIO, WPI